CLAIMS

1. An apparatus, comprising:

a fluidic Micro Electro-Mechanical System (MEMS) that is formed including a polymer layer and a substrate portion, the polymer layer of the apparatus comprising:

a containment portion that in combination with the substrate encloses a fluidic channel, wherein the containment portion includes a deep cross-linked polymer region and a shallow cross-linked polymer region, and

wherein the deep cross-linked polymer region and the shallow cross-linked polymer region of the containment portion are formed as a unitary structure.

2. The apparatus of claim 1, further comprising a resistor located in, on, or adjacent to the substrate.

3. The apparatus of claim 1, wherein a portion of the containment portion that does not contact the substrate includes a shallow cross-linked polymer region and a portion of the containment portion that contacts the substrate includes a deep cross-linked polymer region.

4. The apparatus of claim 3, wherein portions of the containment portion that includes the shallow cross-linked polymer region are on lateral sides of the fluidic channel;

5. The apparatus of claim 3, wherein portions of the containment portion that includes the deep cross-linked polymer region are separated by the fluidic channel from the substrate.

6. The apparatus of claim 1, wherein the apparatus acts as a pump.

7. The apparatus of claim 1, wherein the apparatus acts as a polymerase chain reaction (PCR) reactor.

8. The apparatus of claim 1, wherein the apparatus acts as a separator.

9. The apparatus of claim 1, wherein the apparatus acts as an optical waveguide.

10. The apparatus of claim 1, wherein the apparatus acts as a filter.

11. The apparatus of claim 1, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are produced using direct imaging techniques.

12. The apparatus of claim 1, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are produced using lost wax techniques.

13. The apparatus of claim 1, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are produced using dry film techniques.

14. A method of making a fluidic Micro Electro-Mechanical System (MEMS) on a substrate, comprising:

depositing a polymer material to form a polymer layer on the substrate; and

hardening portions of the polymer layer to create a containment portion from a shallow cross-linked polymer region and a deep cross-linked polymer

region, wherein the shallow cross-linked polymer region and the deep cross-linked polymer region of the containment portion are formed as a unitary structure.

15. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a pump.

16. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a polymerase chain reaction (PCR) reactor.

17. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a separator.

18. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as an optical waveguide.

19. The method of claim 14, wherein at least a portion of the fluidic MEMS acts as a filter.

20. The method of claim 14, further comprising locating a resistor within, of adjacent to, the substrate.

21. The method of claim 14, further comprising spinning the deposited polymer material to make the polymer layer more planar.

22. The method of claim 14, wherein certain portions of the containment portion are fabricated using a strong exposure cross-linking process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

23. The method of claim 14, wherein the method includes direct imaging techniques.

24. The method of claim 14, wherein the method includes lost wax techniques.

25. The method of claim 14, wherein the method includes dry film techniques.

26. A method of making a pump on a substrate, comprising:

depositing a polymer material on the substrate to create a polymer layer; and

hardening portions of the polymer layer to create a first check valve, a second check valve, and a containment portion from the polymer material, wherein the first check valve, the second check valve, and the containment portion are formed as a unitary structure.

27. The method of claim 26, further comprising forming a recessed portion in the substrate that corresponds to each of the first check valve and the second check valve.

28. The method of claim 26, further comprising spinning the deposited polymer material to make the polymer layer more planar.

29. The method of claim 26, further comprising creating a resistor in the substrate, for forming a bubble to create a pressure differential.

30. The method of claim 26, wherein the first check valve and the second check valve are created using a strong exposure cross-linking process.

31. The method of claim 26, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

32. A pump apparatus formed including a polymer layer and a substrate portion, the polymer layer of the pump apparatus comprising:

a first check valve including a deep cross-linked polymer region;

a second check valve including a deep cross-linked polymer region;

a containment portion that in combination with the substrate encloses a fluidic channel; and

wherein the first check valve, the second check valve, and the containment portion are formed in the polymer layer as a unitary structure.

33. An integrated total chemical analysis system that is fabricated on a substrate using a direct imaging process, further comprising:

a portion of the deep cross-linked polymer region that defines lateral fluid boundaries of the integrated total chemical analysis system; and

a shallow cross-linked polymer region for defining upper fluid boundaries of the integrated total chemical analysis system, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region form a unitary structure.

34. The integrated total chemical analysis system of claim 33, that includes at least two devices from the group of a filter, a pump, a waveguide, a polymerase chain reaction (PCR) reactor, and a separator.

35. The integrated total chemical analysis system of claim 33, wherein the deep cross-linked polymer region is cross-linked using a strong direct imaging exposure process.

36. The integrated total chemical analysis system of claim 33, wherein the shallow cross-linked polymer region is cross-linked using a weak direct imaging exposure process.

37. The integrated total chemical analysis system of claim 33, wherein the integrated total chemical analysis system includes a fluidic micro electro-mechanical system (MEM) device.

38. A method comprising:

fabricating using a single process a fluidic micro electro-mechanical system (MEMS) device on a polymer layer deposited on a substrate, the fabricating the fluidic MEMS device includes:

defining lateral fluid boundaries of the fluidic MEMS device using a strong direct imaging exposure process; and

defining upper fluid boundaries of the fluidic MEMS device using a weak direct imaging exposure process.

39. The method of claim 38, further comprising filtering fluid with the fluidic MEMS.

40. The method of claim 38, further comprising heating fluid with the fluidic MEMS.

41. The method of claim 38, further comprising separating fluid with the fluidic MEMS.

42. The method of claim 38, further comprising optically detecting material in a fluid using the fluidic MEMS.

43. The method of claim 38, further comprising pumping fluid with the fluidic MEMS.

44. A method of making a reactor on a substrate, comprising:

forming at least one heating element within, or proximate to, the substrate;

depositing a polymer material on the substrate that creates a polymer layer; and

hardening portions of the polymer layer to create a containment portion, wherein the containment portion is formed as a unitary structure.

45. The method of claim 44, further comprising spinning the deposited polymer material to make the polymer layer more planar.

46. The method of claim 44, wherein the first check valve and the second check valve are created using a strong exposure cross-linking process.

47. The method of claim 44, wherein certain portions of the polymer layer are fabricated using a strong exposure process, while other portions of the polymer layer are fabricated using a weak exposure cross-linking process.

48. A reactor apparatus formed including a polymer layer portion and a substrate portion, the polymer layer portion of the reactor apparatus comprising:

a containment portion that in combination with the substrate encloses a fluidic channel;

a portion of at least one heating element that is applied to at least a portion of the fluidic channel;

wherein the containment portion are formed in the polymer layer as a unitary structure; and

wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

49. A method of making a separator on a substrate, comprising:

depositing a polymer material on the substrate to form a polymer layer;

forming a controllable electric potential source relative to the polymer layer; and

hardening portions of the polymer layer to create a containment portion, wherein the containment portion is formed as a unitary structure.

50. The method of claim 49, further comprising spinning the deposited polymer material to make the polymer layer more planar.

51. The method of claim 49, wherein the separator utilizes electrophoresis to separate particles.

52. The method of claim 49, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

53. A separator apparatus formed including a polymer layer and a substrate portion, the polymer layer of the separator apparatus comprising:

a containment portion that in combination with the substrate encloses a fluidic channel, wherein the containment portion is formed in the polymer layer as a unitary structure.

54. A method of making a filter including a plurality of filter elements on a substrate, comprising:

depositing a polymer material on the substrate to form a polymer layer; and

hardening portions of the polymer layer to create the plurality of filter elements and a containment portion from the polymer layer, wherein the plurality of filter elements and the containment portion are formed as a unitary structure.

55. The method of claim 54, further comprising spinning the deposited polymer material to make the polymer layer more planar.

56. The method of claim 54, wherein the plurality of filter elements are created using a strong exposure cross-linking process.

57. The method of claim 54, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

58. A filter apparatus formed including a polymer layer and a substrate portion, the polymer layer of the filter apparatus comprising:

a plurality of filter elements including a deep cross-linked polymer region;

a containment portion that in combination with the substrate encloses a fluidic channel; and

wherein the plurality of filter elements and the containment portion are formed in the polymer layer as a unitary structure.

59. A method of making an optical waveguide on a substrate, comprising:

depositing a polymer material on the substrate to form a polymer layer; and

hardening portions of the polymer layer to create an input optical conduit, a focusing lens, and a containment portion from the polymer layer, wherein the

input optical conduit, the focusing lens, and the containment portion are formed as a unitary structure.

60. The method of claim 59, further comprising spinning the deposited polymer material to make the polymer layer more planar.

61. The method of claim 59, wherein the input optical conduit and the focusing lens are at least partially created using a strong exposure cross-linking process.

62. The method of claim 59, wherein certain portions of the containment portion are fabricated using a strong exposure process, while other portions of the containment portion are fabricated using a weak exposure cross-linking process.

63. A waveguide apparatus formed including a polymer layer and a substrate portion, the polymer layer of the waveguide apparatus comprising:

an input optical conduit including a deep cross-linked polymer region;

a focusing lens including a deep cross-linked polymer region;

a containment portion that in combination with the substrate encloses a fluidic channel; and

wherein the input optical conduit, the focusing lens, and the containment portion are formed in the polymer layer as a unitary structure.

64. A method comprising:

depositing a structural material layer that defines the lateral boundaries of at least one fluidic channel of a fluidic micro electromechanical system (MEMS) device; and

laminating a dry film layer on the deposited structural material to at least partially define an upper layer that of the at least one fluid channel.

65. A method comprising:

depositing a sacrificial material on a substrate;

depositing a polymer layer on the substrate and the sacrificial material; and

removing the sacrificial material to at least partially define boundaries of at least one fluidic channel of a fluidic micro electromechanical system (MEM) device, the at least one fluidic channel is at least partially defined by a portion of the polymer layer and a portion of the substrate.

66. An anchor apparatus, comprising:

a deep cross-linked polymer region;

a shallow cross-linked polymer region supported by the deep cross-linked polymer region, the shallow cross-linked polymer region having a thru-hole formed therein, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region are attached; and

a connector portion that secures to the thru-hole, wherein the top-hat structure enhances the attachment of the connector to the thru-hole.

67. The anchor apparatus of claim 66, further comprising glue to secure the connector portion to the thru-hole.

68. The anchor apparatus of claim 67, wherein the shallow cross-linked polymer region forms an overhang portion, wherein the glue is affixed to the overhang portion in a manner to enhance the attachment of the connector to the thru-hole.

69. The anchor apparatus of claim 66, further comprising epoxy to secure the connector portion to the thru-hole.

70. The anchor apparatus of claim 66, wherein the deep cross-linked polymer region and the shallow cross-linked polymer region form a top-hat structure.